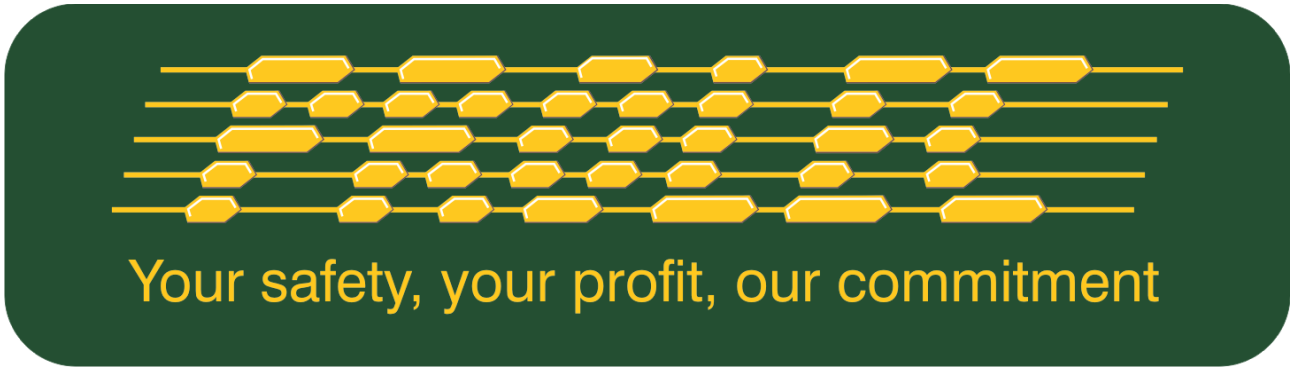
562300-000, Issue1.0, April 2013

PME 300
PME300+
Machine Envelope Controller

Operators Manual



This guide describes operation of the

PROLEC PME ENVELOPE SAFETY SYSTEM FOR CONSTRUCTION PLANT

Model covered :	PART No.	MODEL Ref
	PME300	PME300 - MEC SYSTEM
	PME300+	PME300+ - MEC SYSTEM

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THIS ENVELOPE SAFETY SYSTEM IS NOT SUITABLE FOR USE IN EXPLOSIVE ATMOSPHERES. ADJUSTMENT BY UNAUTHORISED PERSONS WILL INVALIDATE ANY WARRANTY OR CERTIFICATION SUPPLIED. IF A PROBLEM ARISES WHICH CANNOT BE RECTIFIED USING THIS GUIDE, AUTHORISED SERVICE SHOULD BE SOUGHT.

Any alterations or modifications to machine components which affect this system and any system component failure must be reported to Prolec Ltd or via the machine convertor/ service agreement holder. This manual must be kept with the product and be passed on to any subsequent user of the product.
Whilst every effort has been made to ensure the accuracy of the information supplied in this manual, Prolec Ltd cannot be held responsible for any errors or omissions.

Manufacturers original instructions.

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1 Use of this Document

This user guide is intended for persons familiar with the use of construction plant undertaking lifting operations.

WARNING denotes information about particular risks which may be generated by certain applications, by using certain fittings, and about additional protective measures which are necessary for such applications.

Caution, care, risk situation

HAZARD Actions that can lead to serious injury or death

2 Notices

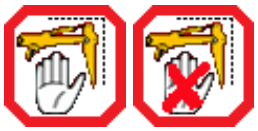
Adjustment by unauthorised persons will invalidate any warranty or certification supplied. If an error condition is displayed which cannot be rectified using this guide, halt any operation, seek authorised service immediately and do not continue operation until the fault

3 System Identification

The PME system provides an envelope safety function

This safety function is achieved through real time monitoring some or all of the machine's moving parts (booms, other articulations, turret etc) and its environment (ground pitch and inclination) and actively determining the safety of the current operation where appropriate limits have been set.

- Machine envelope controllers (MEC) prevent movements that would bring parts of the machine into hazardous areas.



During operation the indicators shown here on the left are displayed on the screen to clearly identify the function supported by your PME 300. Functions may not be available i.e. when envelope monitoring is switched off, if this is the case a cross will be painted over the function icon.

PME300 and PME300+ are NOT height limiting devices

4 Operating and Hazard Situation Recommendations

Operating Recommendations

When using envelope monitoring:

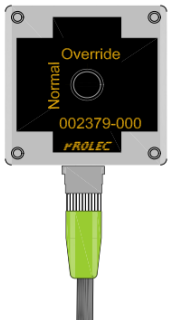
- When setting a slew restriction , make sure any implement attached is in its least favourable position
- Check for correct operation once the restriction or restriction have been set
- Reduce operating speed
- Reset slew restriction if the machine
- Do not move the equipment quickly when close to a restriction
- Do not operate the machine in a reckless manor
- Do not travel with a restriction set
- Reset the slew restriction if the machine is relocated

Hazard Situation Recommendations

In a limit hazard state:

- Return the control levers to neutral once a limit has been reached if appropriate
- Operate the machine at a slow speed

4.1 MEC Override



The system can optionally be fitted with a key operated master override switch. Turning the switch to the override position will allow normal operation of any of the hydraulic services regardless of safety status. When the unit is in override the external alarms will stay active, and the beacon (if fitted) will indicate that the machine is overridden, the red LED will flash and an ‘In Override’ message will appear on the display.

The override key switch should only be used if the safety system is not operational due to a fault and the machine needs to be moved due to its location presenting a hazard.

The override status shall be recorded in the system data log. To access the override key switch, the seal must be broken.

5 Operating Instructions

5.1 Power Up

The PME system automatically powers up when the machines ignition is switched on. The in-cab unit incorporates a 4.3” high resolution LCD display and is controlled with three buttons at each side. Three status LEDs and an internal alarm provide further information.

This machine is equipped with an electronic slew limiter. With responsible use this device will provide reliable protection for both personnel and plant.
When setting a limit ensure any attached tool is in its least favourable position.
Check for correct operation once a limit has been set.
Operate the machine at a responsible speed.
Release the control levers if a limit is reached.
Operate the machine in a reckless manner.
Raise the equipment quickly when close to a limit.
Travel with a limit set.
Failure to observe these guidelines can result in serious injury or death. Only use this equipment if fully familiar with its operation.
Press any button to continue

The system will perform a self check at start up:

1. All LEDs will flash, the internal display alarm and the external alarm will sound.
2. The RED LED will light indicating the system is starting and performing a self test.
3. Once the self test is complete, the GREEN LED will light and the system will become active. A safety warming message is displayed, pressing any button activates slew limitation Mode. Any previous limits set will be enabled. The system is now ready for use.
4. The system can be configured to require a user login - if this is enabled, see section 5.3.

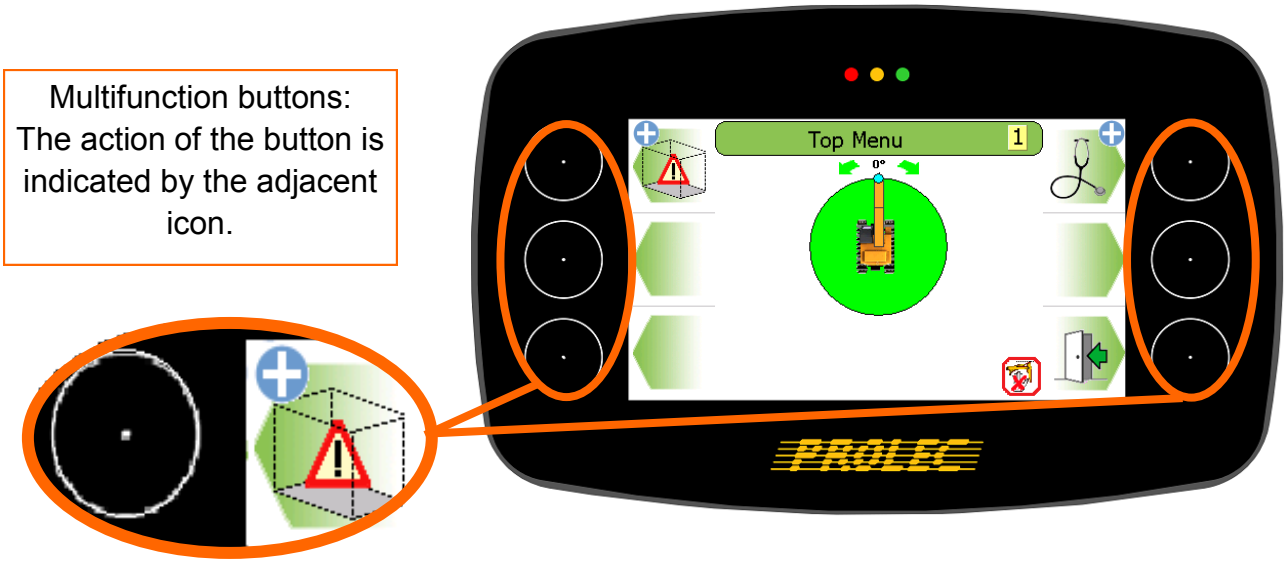
If the RED LED remains lit, a fault has been detected, halt any operation, seek authorised service immediately and do not continue operation until the fault has been remedied.

The display is secured to the machine using a flexible ball mounting allowing easy adjustment for personal viewing preference.

5.2 Using the Display

The display is operated by using the buttons adjacent to a function icon. The buttons can open a sub menu, turn a function ON or OFF, set a value, toggle through multiple screens, no one button has a single function. The button icon will turn black/purple when the button has been activated. PME300 screen shown below. Note that the side view of the machine shown in PME300+ is fixed and does not follow the movement of the machine.

Multifunction buttons: The action of the button is indicated by the adjacent icon.



A secondary symbol can appear in the top left corner of an icon, these mean :

The plus symbol indicates a sub menu will be opened if selected.

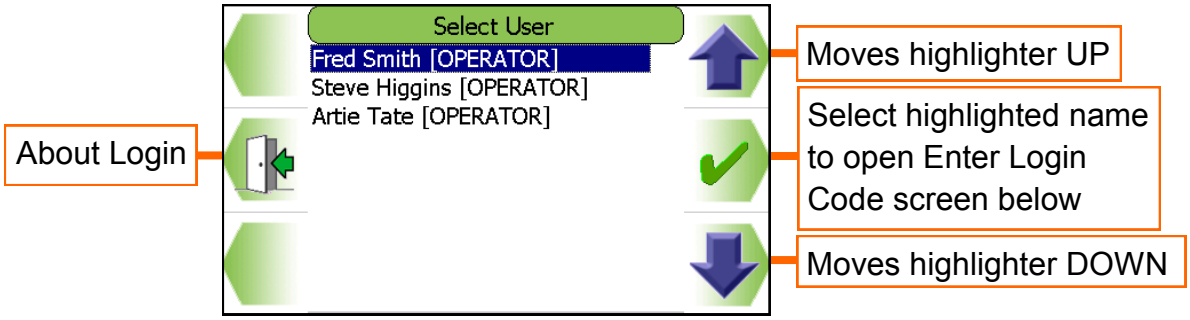
The cycle symbol indicates that multiple features are available.

The on / off symbols indicate if a feature is ON or OFF. Red is ON and grey is OFF.

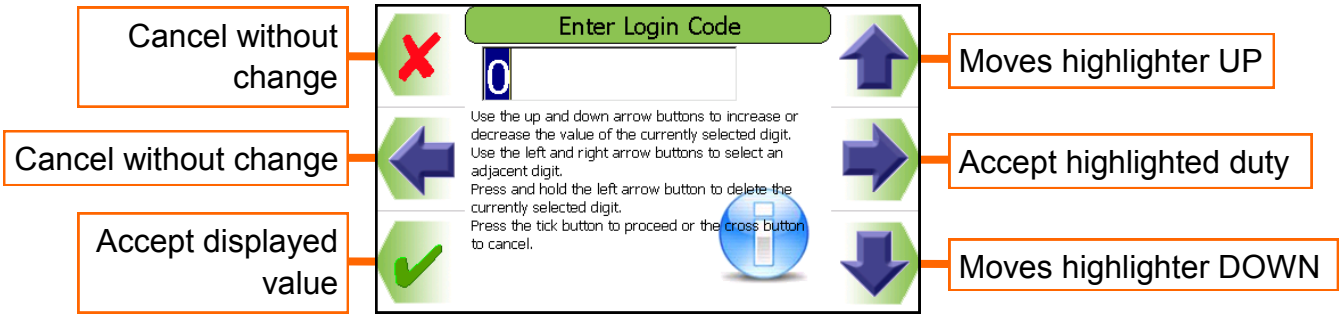
Help is available for each button. To access the help, push and hold the button for three seconds. The help screen can be cleared by pressing any of the six buttons. PME is still active when displaying help messages, if the Lifting Mode is active and or a height limit is set any alarm or warning condition will be indicated.

5.3 User Login

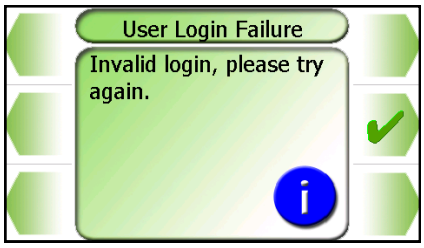
If PME has been configured to work with the built-in user list, the system will prompt for a user login pass code. Select the user name required and the login code screen will appear.



Using the arrow buttons to enter a valid pass code. The previous pass code digits will be replaced with a star as the code is entered. Press the TICK button to confirm the login pass code. If a valid pass code is entered the system will commence normal operation.


Cancel without change
Cancel without change
Accept displayed value
Enter Login Code
0
Use the up and down arrow buttons to increase or decrease the value of the currently selected digit.
Use the left and right arrow buttons to select an adjacent digit.
Press and hold the left arrow button to delete the currently selected digit.
Press the tick button to proceed or the cross button to cancel.
Moves highlighter UP
Accept highlighted duty
Moves highlighter DOWN

If an incorrect login code is entered, a failure screen will be displayed. Press the TICK button to return to the Select User screen.



5.4 User Logout

If a user is logged in as the current user, they can select the logout screen by holding an exit key down for three seconds.

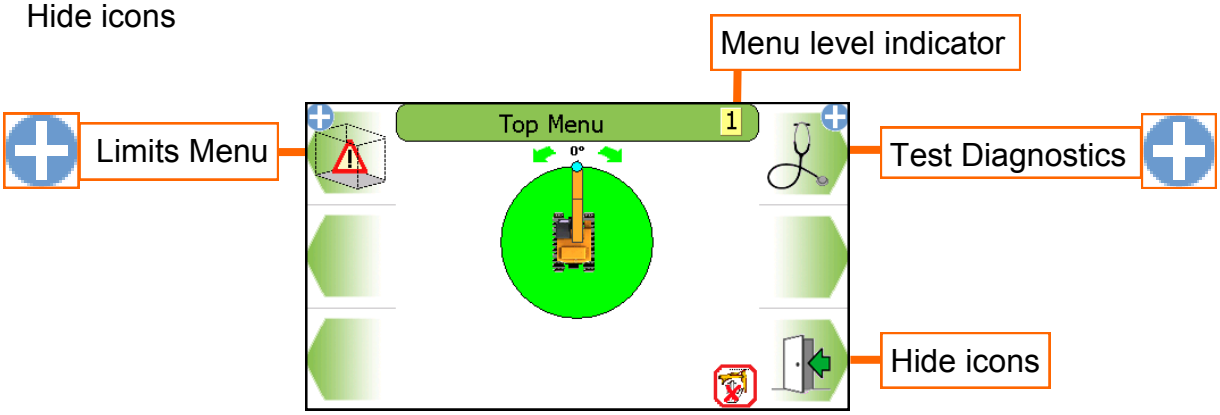
Once logout has been confirmed the login screen will be automatically displayed. Press the CROSS button to stay logged in, the screen will return to that previously shown.

6 Top Menu

The Top Menu screen allows access to all the system functions. To reveal the icons, if hidden, press any button. To return to the Top Menu from a sub menu press the EXIT button until the Top Menu is displayed.

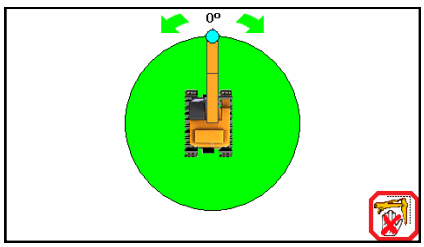
Top Menu button functions:

- Limits menu
- Test / Diagnostics
- Hide icons



To hide the icons when at the Top Menu, press the EXIT button once more.

PME300 screen shown here.

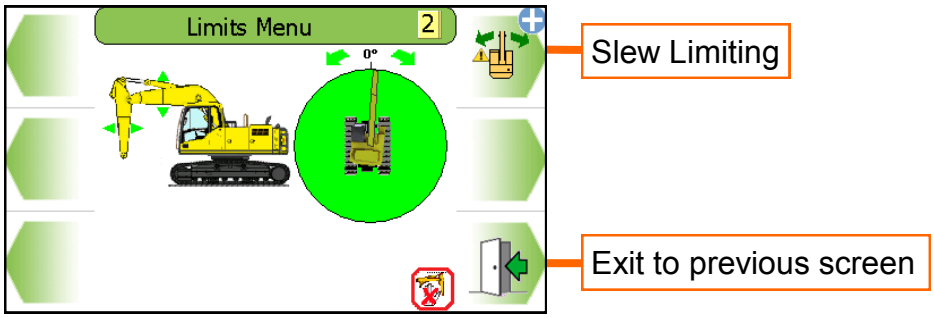


7 Envelope Monitoring

PME300 and PME300+ is configured for Machine Envelope Control (MEC) only. MEC will warn and prevent equipment motion. MEC is achieved by interacting with the machines hydraulics, this allows motion to be cut to any section of equipment that has reached a restriction but allow other sections to operate unhindered unless they too reach the set restriction .

PME300 monitors the slew angle of the machine but is unaware of any articulation or implement fitted, therefore make sure any articulation or implement attached is in its least favourable position.

PME300+ monitors the slew angle, the furthest part of the machine and the counterweight when used with a virtual wall type restriction but is unaware of any implement fitted therefore make sure any implement attached is in its least favourable position.



MEC

OFF: when operating with an inactive limit the indicator will have a cross painted on it.

ON: when operating with an active limit the indicator will not have a painted on cross on it.

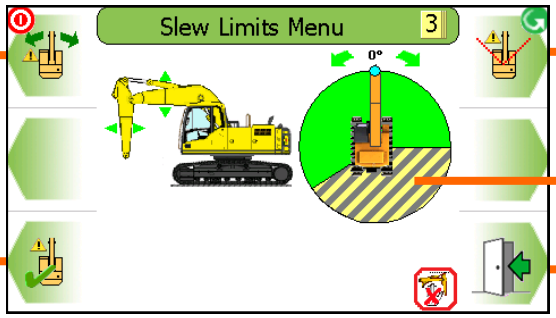
Care should be taken to test that the limit is set correctly.

Observe the operational limitations given in section 4.

7.1 Limits Menu

Slew restriction can be set by manually moving the machine to the desired limit. PME300+ Slew limits screen shown here.

Switches slew monitoring ON and OFF



PME300+ Only

Current hazard zone shown if a slew limit is ON.

Press this button to start the setup procedure

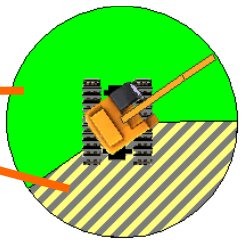
Exit to previous menu

Using the Slew Limits Menu, the Slew limit can be switched ON and OFF (a Confirm Operation screen will be displayed). The type of slew restriction can be selected (PME300+ only) and is be set by moving the machine.

With the slew limit ON:

The Green area indicates the safe zone

The Hatched area indicates the hazard zone



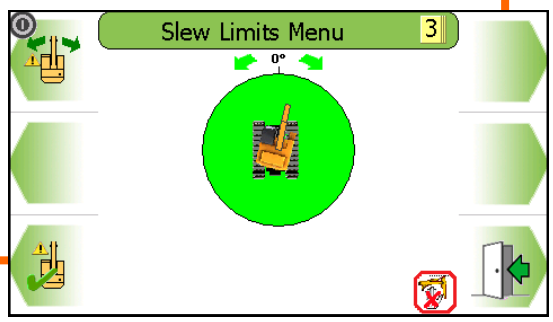
The type of slew restriction cannot be altered if a limit is currently ON. The warning message must be acknowledged.

If altering the type of slew Restriction (PME300+ only), the current limit will be lost.
If the slew limit was not successfully set then a warning message which must be acknowledged will be displayed.

7.1.1 Angular Slew Restriction- using Current Slew Angle

Select angular slew restriction, PME 300 is supports angular slew only. PME300 Slew limits screen shown here.

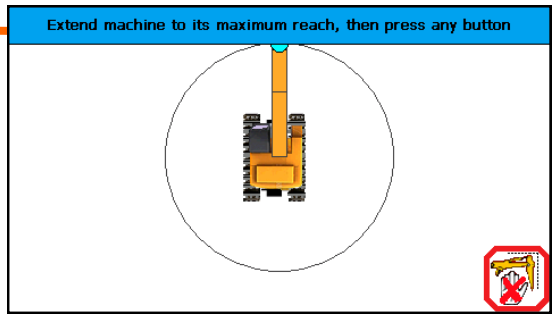
Icon appears in 300+ only



Press this button to start the setup procedure

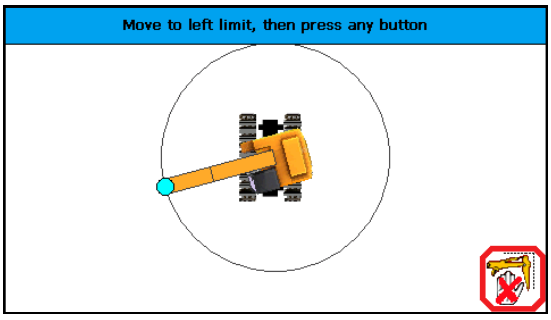
Step One

Step by step instructional banner



Position articulations and any implement attached to the least favourable position.

Step two



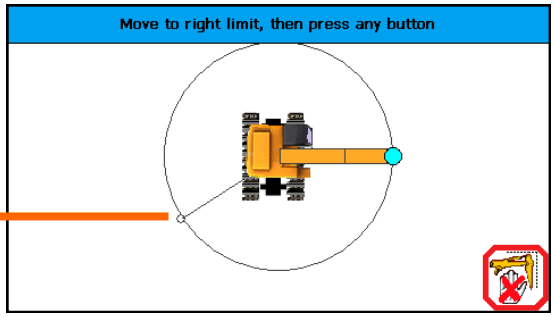
Move to the left slew limit, press any button to set the left limit. A marker will be placed to indicate its position.

Continued on next page

Step three

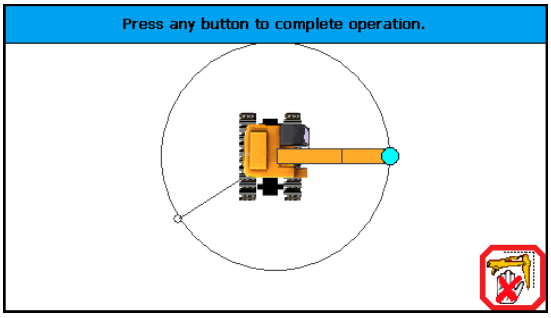
Move to the right slew limit, press any button to set the left limit. Another marker will be placed here.

Slew left restriction marker

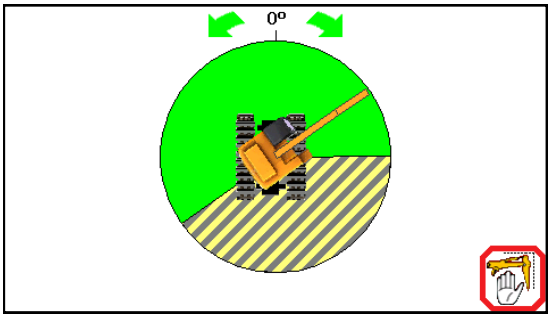


Step four

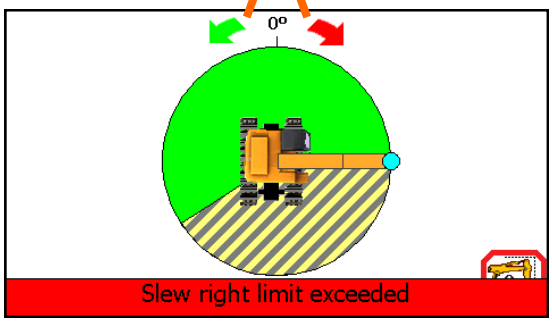
Press any button to complete.



The hatched hazard zone will be shown on the main screen.
Check the limits are working as required.



Safe Directional indicators. The left and right arrows indicate if it is safe GREEN, or unsafe RED to slew in that direction

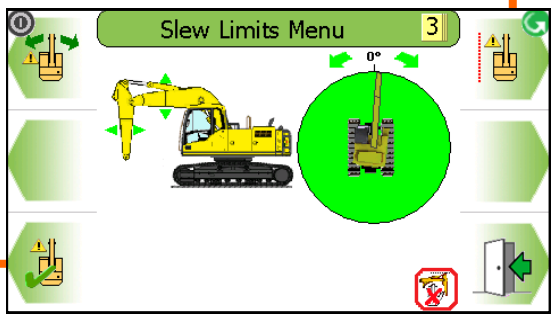


Once slew limits are set, the internal alarm will sound and the RED LED will light if the equipment exceeds the either limit. Always check that the slew limit activates at the set points. The restriction cannot be deactivated if in the alarm state. Do not travel. Observe the operational limitations given in section 4.

7.1.2 Virtual Wall Restriction- using Virtual Wall

Select single vertical wall restriction (PME300+ only), follow the on screen instructions.

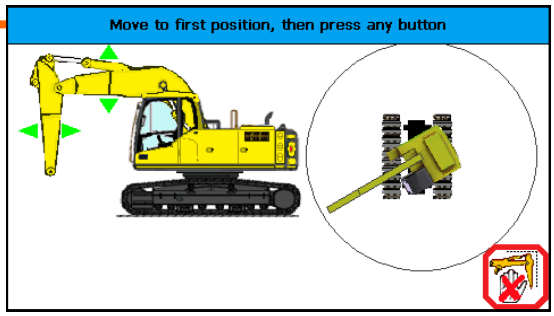
Set to Virtual Wall



Press this button to start the setup procedure

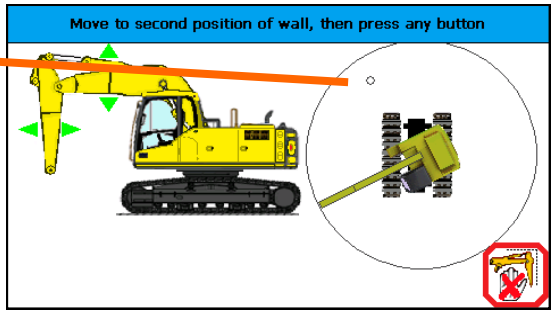
Step One

Step by step instructional banner



Move the dipper to one end of the virtual wall, press any button to set the limit. A marker will be placed here.

Virtual wall marker



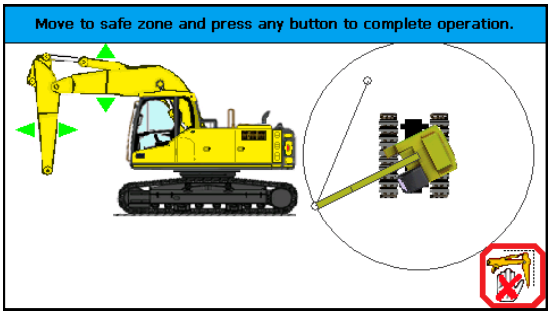
Step two

Move the dipper to the other end of the virtual wall, press any button to set the limit.

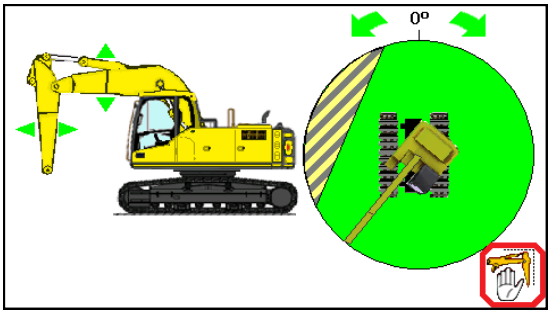
Continued on next page

Step three

Move the equipment away from the limit and press any button to complete.

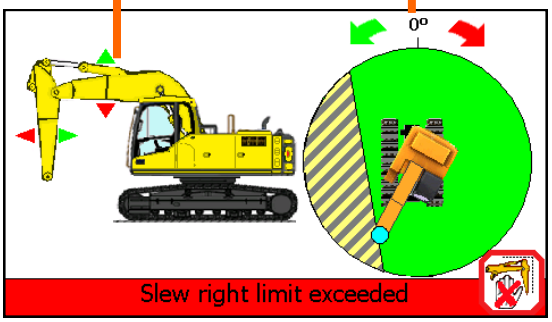


The hatched hazard zone will be shown on the main screen.
Check the limit is working as required.



Safe Directional indicators. The triangles indicate if it is safe GREEN, or unsafe RED to movement a particular articulation.

Safe Directional indicators. The left and right arrows indicate if it is safe GREEN, or unsafe RED to slew in that direction.

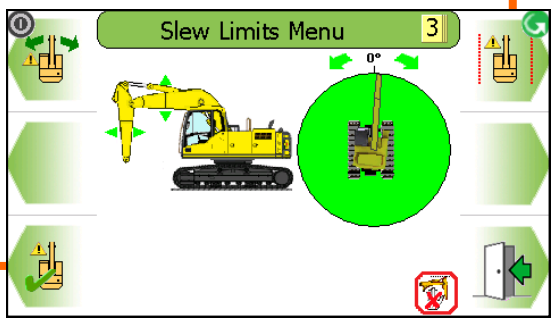


Once slew limits are set, the internal alarm will sound and the RED LED will light if the equipment exceeds the either limit. Always check that the slew limit activates at the set points. The restriction cannot be deactivated if in the alarm state. Do not travel. Observe the operational limitations given in section 4.

7.1.3 Twin Virtual Wall Restriction- using Twin Virtual Walls

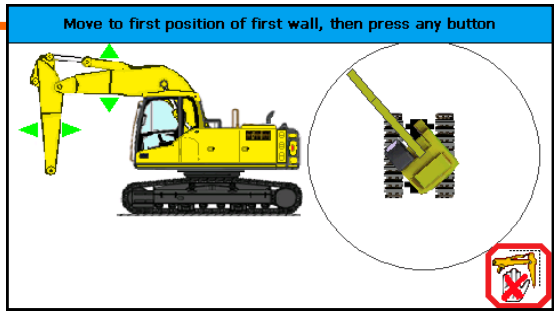
Select twin vertical wall restriction (PME300+ only), follow the on screen instructions.

Set to twin Virtual Wall



Press this button to start the setup procedure

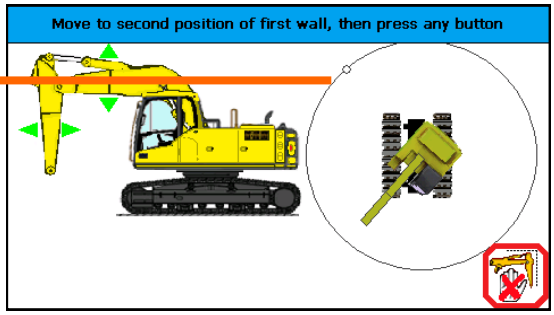
Step by step instructional banner



Step One

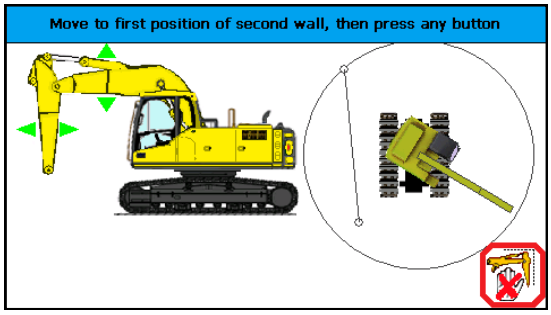
Move the end of the dipper to one end of the FIRST virtual wall, press any button. A marker will be placed here.

Virtual wall marker



Step two

Move the end of the dipper to the other end of the FIRST virtual wall, press any button. A marker will be placed here.



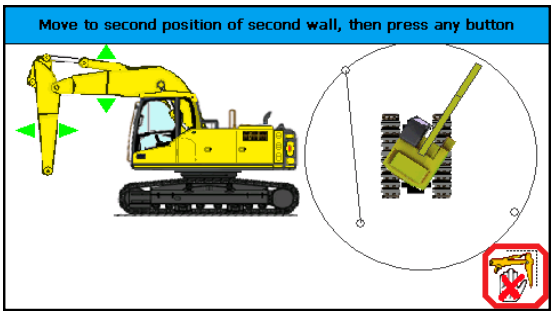
Step three

Move the end of the dipper to one end of the SECOND virtual wall, press any button. A marker will be placed here.

Continued on next page

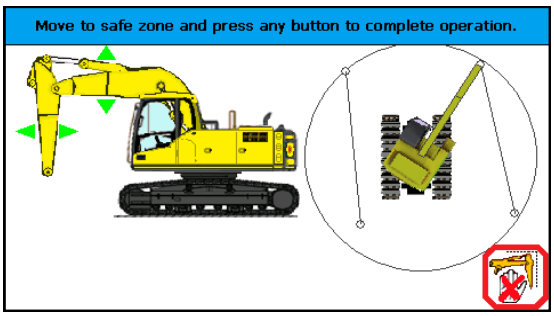
Step four

Move the dipper to the other end of the SECOND virtual wall, press any button. A marker will be placed here.

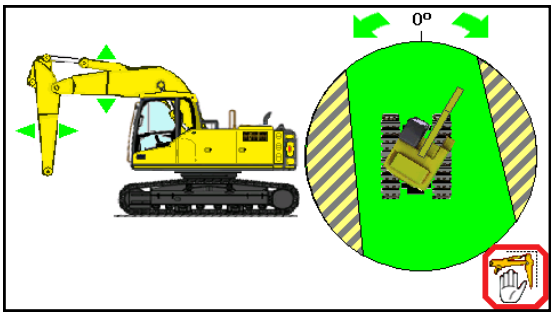


Step four

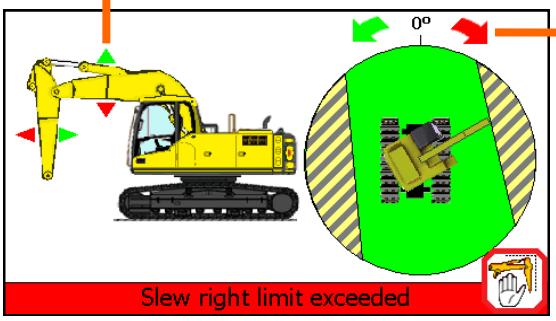
Move the equipment away from the limit and press any button to complete.



The hatched hazard zones will be shown on the main screen.
Check the limits are working as required.



Safe Directional indicators. The triangles indicate if it is safe GREEN, or unsafe RED to movement a particular articulation.



Safe Directional indicators. The left and right arrows indicate if it is safe GREEN, or unsafe RED to slew in that direction.

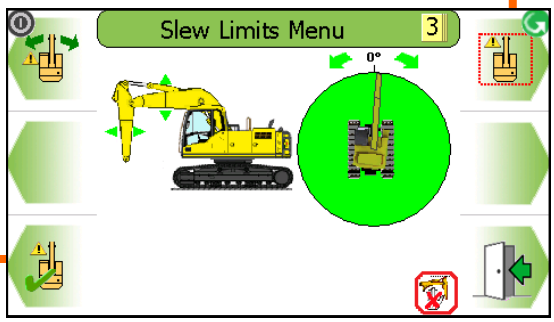
Once slew limits are set, the internal alarm will sound and the RED LED will light if the equipment exceeds the either limit. Always check that the slew limit activates at the set points. The limit cannot be de-activated if in the alarm state. Do not travel. Observe the operational limitations given in section 4.

7.1.4 Multipoint Envelope Restriction- using Multipoint Wall

Select multipoint envelope restriction (PME300+ only), follow the on screen instructions.

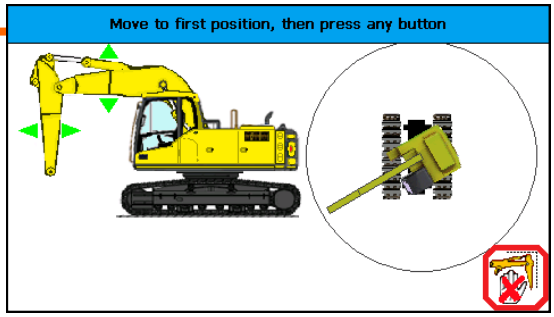
Set to multipoint

Any number of points can be used, four are shown in the example below.



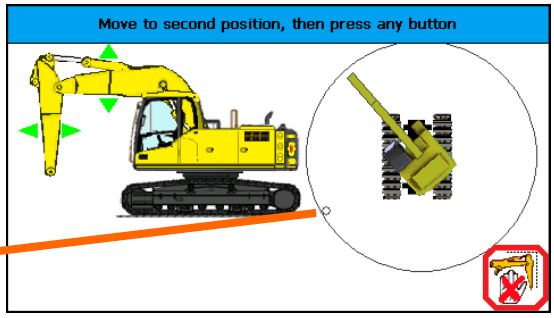
Press this button to start the setup procedure

Step by step instructional banner



Step One

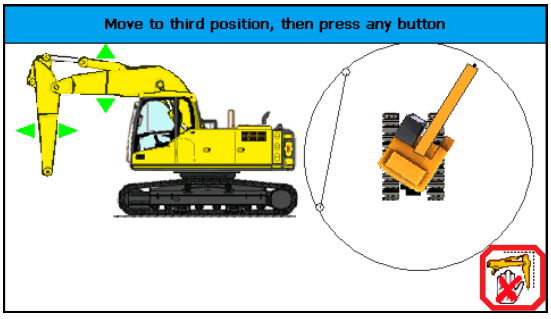
Move the end of the dipper to the FIRST point of the box, press any button. A marker will be placed here.



Step two

Virtual wall marker

Move the end of the dipper to the SECOND point of the box, press any button. A marker will be placed here.

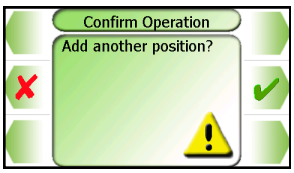


Step three

Move the end of the dipper to the THIRD point of the box, press any button. A marker will be placed here.

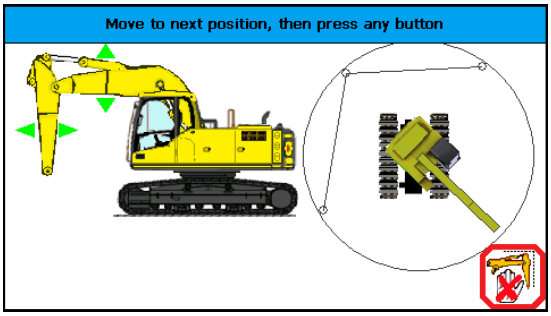
Step four

Confirm if another position is needed, the tick is selected in this example



Step five

Move the end of the dipper to the FORTH point of the box, press any button. A marker will be placed here.

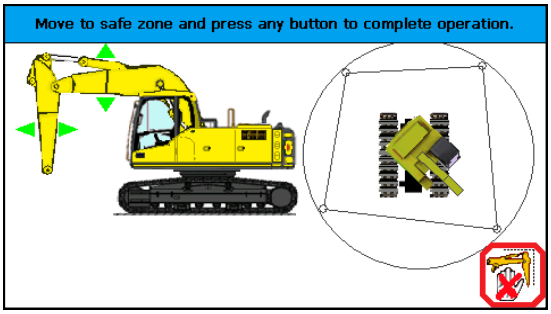


Step six

Confirm if another position is needed, the cross is selected in this example

Step seven

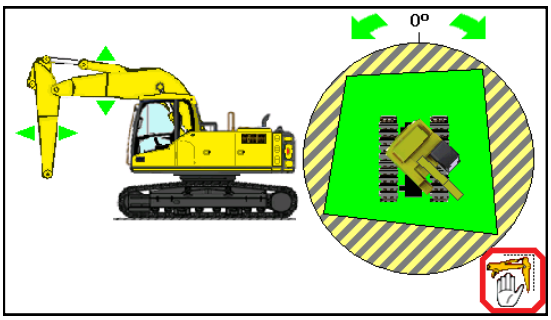
Move the end of the dipper the equipment away from the limit and press any button to complete.



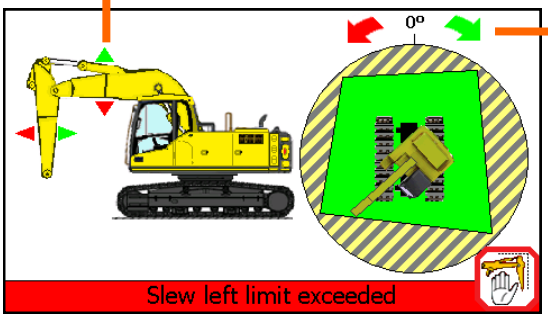
Continued on next page

7.1.4 Multipoint Envelope Restriction- using Multipoint Wall continued

The hatched hazard zones will be shown on the main screen.
Check the limits are working as required.



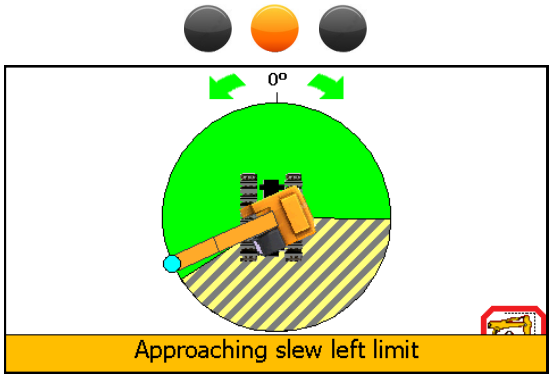
Safe Directional indicators. The triangles indicate if it is safe GREEN, or unsafe RED to movement a particular articulation.



Safe Directional indicators. The left and right arrows indicate if it is safe GREEN, or unsafe RED to slew in that direction.

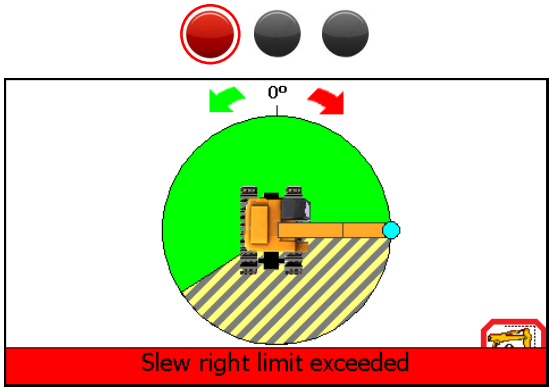
Once slew limits are set, the internal alarm will sound and the RED LED will light if the equipment exceeds the either limit. Always check that the slew restrictions activates at the set points. The restriction cannot be deactivated if in the alarm state. Do not travel. Observe the operational limitations given in section 4.

7.1.5 Machine Envelope Controller (MEC) - Slew / Wall

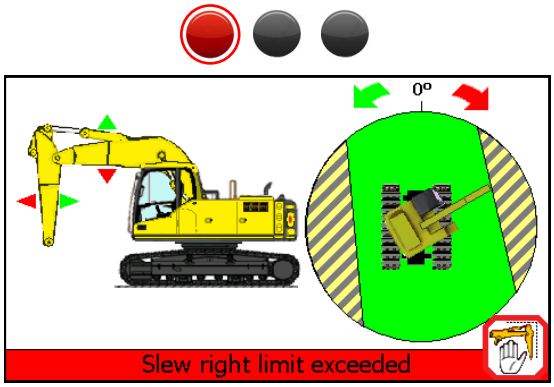


If the equipment enters the approach limit* an 'Approaching slew limit' message will appear, the internal alarm will beep and the amber LED will be lit.

MEI systems will cut motion to any section of equipment that has reached a limit but allow other sections to operate unhindered unless they too reach the set limit.



If the equipment reaches the limit, the appropriate motion will be controlled.



- The safe directional indicators will be red. Unsafe motion is indicated by RED arrows/triangles, safe motion is indicated by GREEN arrows/ triangles
- The red LED will flash
- The internal alarm will sound
- A warning message will be displayed

*The approach limit is configurable at point of calibration, check system operation before commencing work.

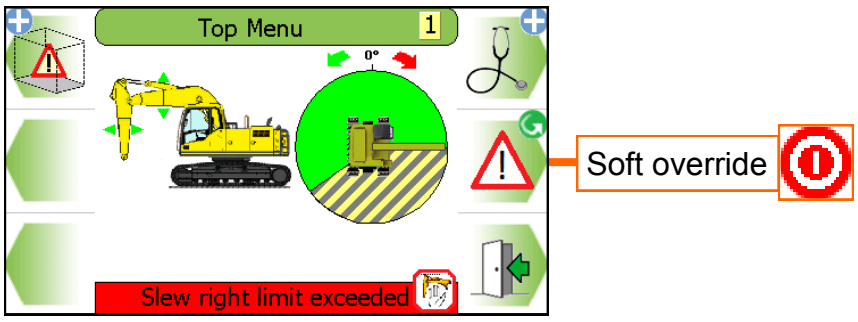
See sections 7.1 for hydraulic override details.

Once slew limits are set, the internal alarm will sound and the RED LED will light if the equipment exceeds the either limit. Always check that the slew limit activates at the set points. The restriction cannot be deactivated if in the alarm state. Do not travel. Observe the operational limitations given in section 4.

7.2 Limit Control Override

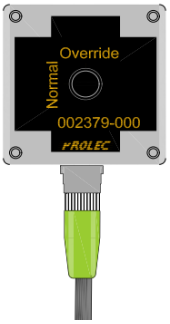
7.2.1 Soft Override

After three seconds a soft override button will appear in the right hand middle icon if the Top Menu screen is selected. If the soft override button is pressed, the machine hydraulics will be re-enabled. However, the internal alarm will stay active, the red LED will flash, the beacon (if fitted) will switch off and an In Override message will appear on the display. Once the alarm condition has been corrected the RCC will automatically clear the override request and revert to normal operation.



7.2.2 Master Override key Switch

The system can optionally be fitted with a key operated Master override switch. Turning the switch to the override position will allow normal operation of any of the hydraulic services regardless of safety status. When the unit is in override the internal alarm will stay active, and the beacon (if fitted) will indicate that the machine is overridden, the red LED will flash and an In Override message will appear on the display. See section 4.1 for further details.



Once slew limits are set, the internal alarm will sound and the RED LED will light if the equipment exceeds the either limit. Always check that the slew limit activates at the set points. The limit cannot be de-activated if in the alarm state. Do not travel. Observe the operational limitations given in section 4.

8 System Messages

8.1 On Screen Messages

Approaching Slew limit	Equipment within *10 degrees of set limit
Slew Limit exceeded	Equipment has reached/exceeded set limit

*The approach limit is configurable at point of calibration, check system operation before commencing work.

PME continuously monitors the presence and condition of the safety controller and sensors. If the safety controller or any sensor fails an error message box will appear at the bottom of the display. In the event of a failure, the cab mounted beacon (if fitted) will indicate that the system is NOT active, the display red LED will flash and the internal and external alarms will sound.

8.2 LED and Internal Alarm Warnings

The table below shows the state of the three LEDs on the display and the internal alarm with respect to system status.

LED and Internal Alarm status	System status
	Off
	Start up, Power Down
	Operational: System OK, no warnings, hazards, or errors
1 Hz	Warning: Approach to envelope limit
Continuous	Hazard; breach of an envelope limit
	Maintenance: Engineering access active
8 Hz	Error: PME hardware/software error, or sensor failure

9 Daily Checks

- Display - check for damage and correct operational
- Safety Controller - check for damage and correct operational
- Sensors and sensor cabling - check for damage
- Connectors - check for damage
- Alarm / beacon functionality

See section 11.1 for test / diagnosis features.

If an issue is discovered which cannot be rectified using this guide, halt any operation, seek authorised service immediately and do not continue operation until the fault has been remedied.

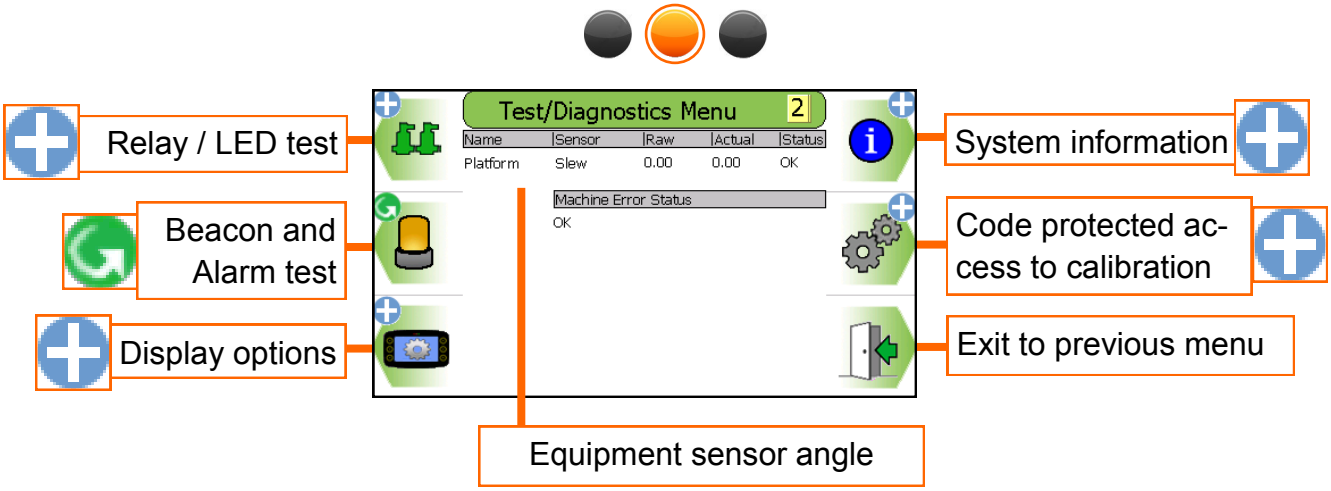
10 Repair

Once a repair has been carried out and tested, the following must be checked:

Required Checks	Section
Slew Angle Check	11.2
Relay Check	11.1
Alarm, LED and Beacon Check	11.3
Maintenance review	15.1

11 Test / Diagnostics

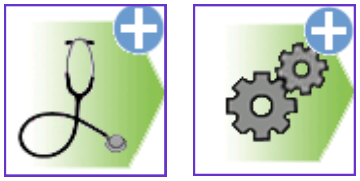
The system test function is available from the main operating screen. This option allows the functionality of the system to be verified, and basic trouble-shooting to be performed. In this mode, the amber LED will flash to indicate that the system is in maintenance mode. The system will continue to monitor any limits that are active and the Lifting Mode (if active) will continue to monitor machine safety status. Alarm conditions and warnings / controls will be issued as normal.

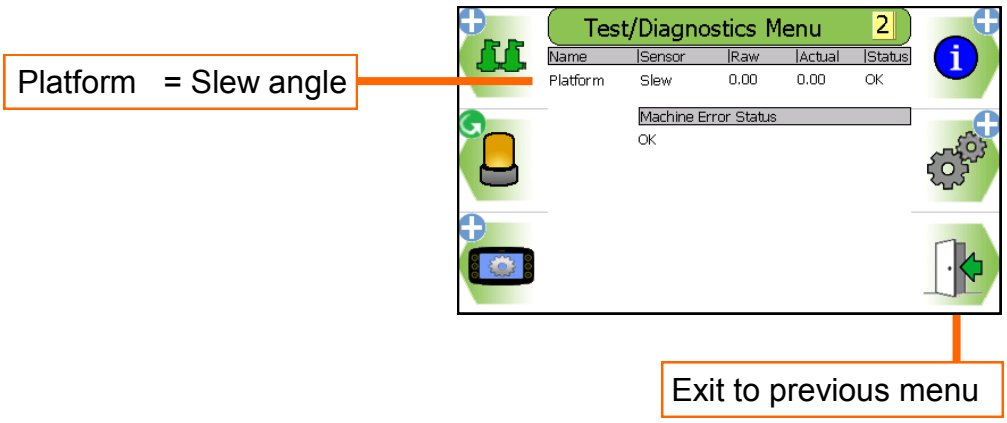


The image shown is an example only. The exact contents of the sensor list will depend on machine type and PME specification.

11.1 Relay Function Test

11.2 Slew Angle





11.3 Beacon, LED Alarm Function Test

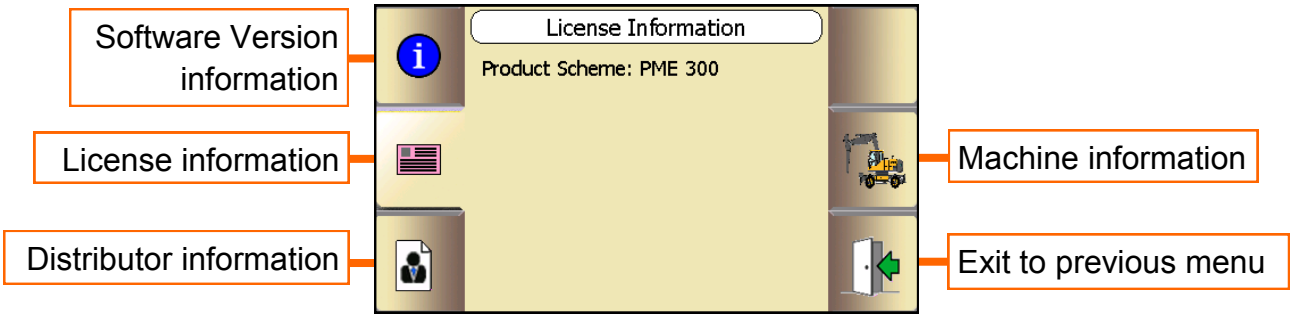
Press the Beacon button to activate the alarm

Press the Alarm button to activate the LEDs

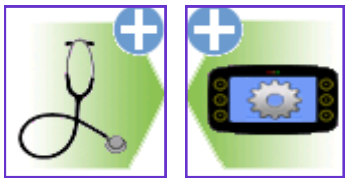
Press the Alarm button to activate the beacon

12 System Information

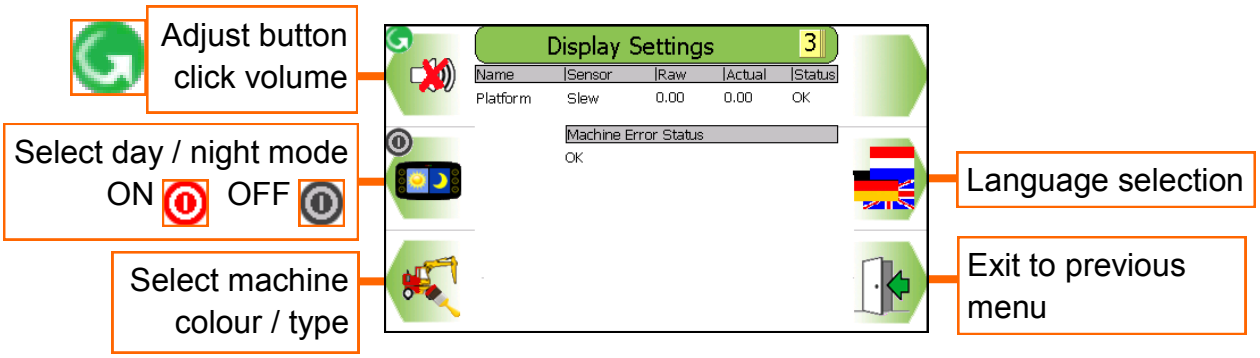
Information regarding the system can be found from this menu.



13 Display Settings



The display brightness, button click volume, and the displayed machine colour and type can be adjusted from this menu.



13.1 Day / Night Mode

To make viewing the display more comfortable at night, the display brightness can be switched to a preset ‘night mode’. The system will default to day mode on power up.

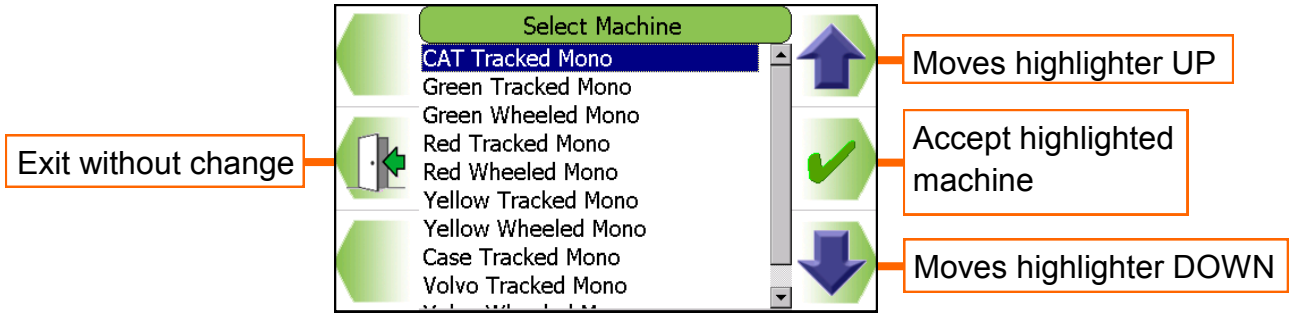
Select day / night mode:

Day mode ON
Full display brightness

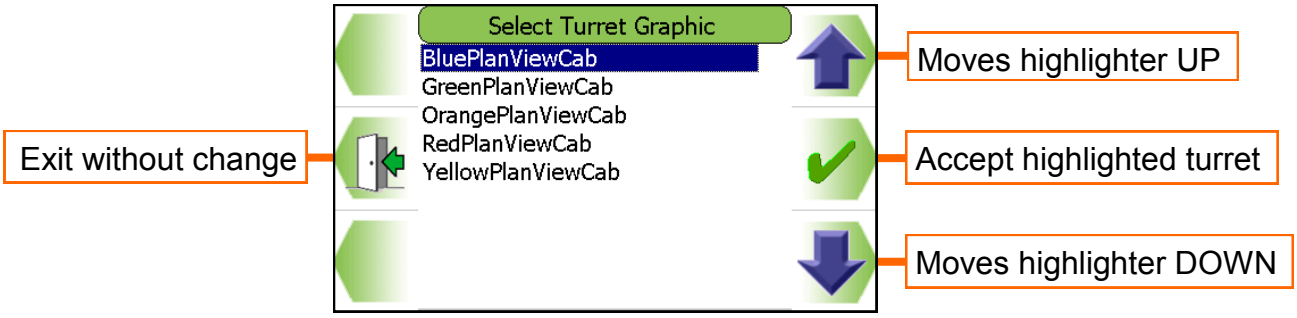
Night mode ON
Reduced display brightness

13.2 Select Display Machine

An appropriate machine type for the display can be selected from this list.

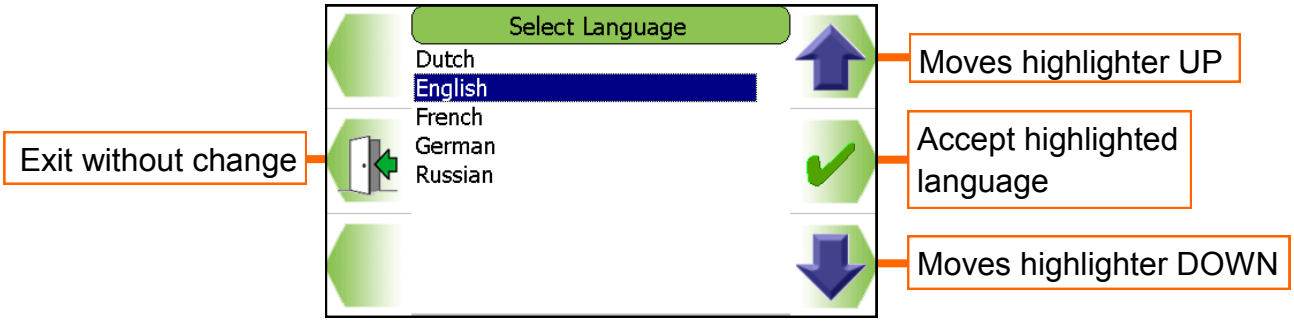


An appropriate turret type for the display can be selected from this list.



13.3 Select Language

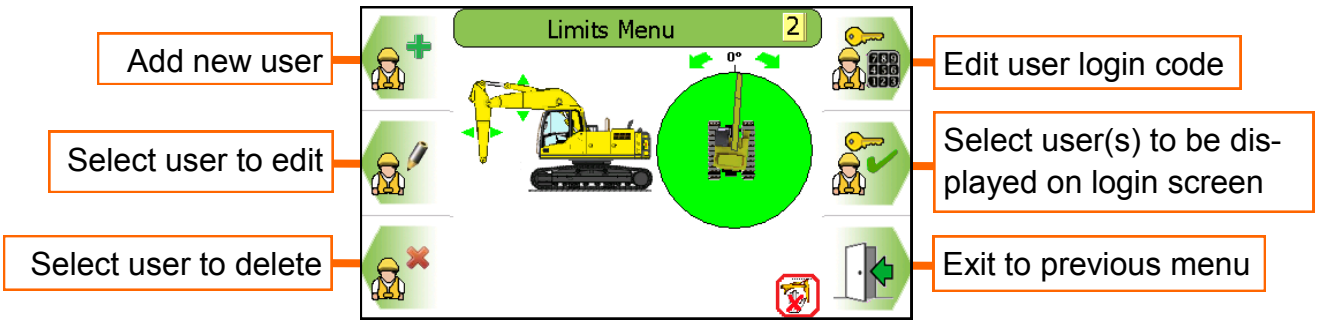
An appropriate machine type for the display can be selected from this list.



14 User Login

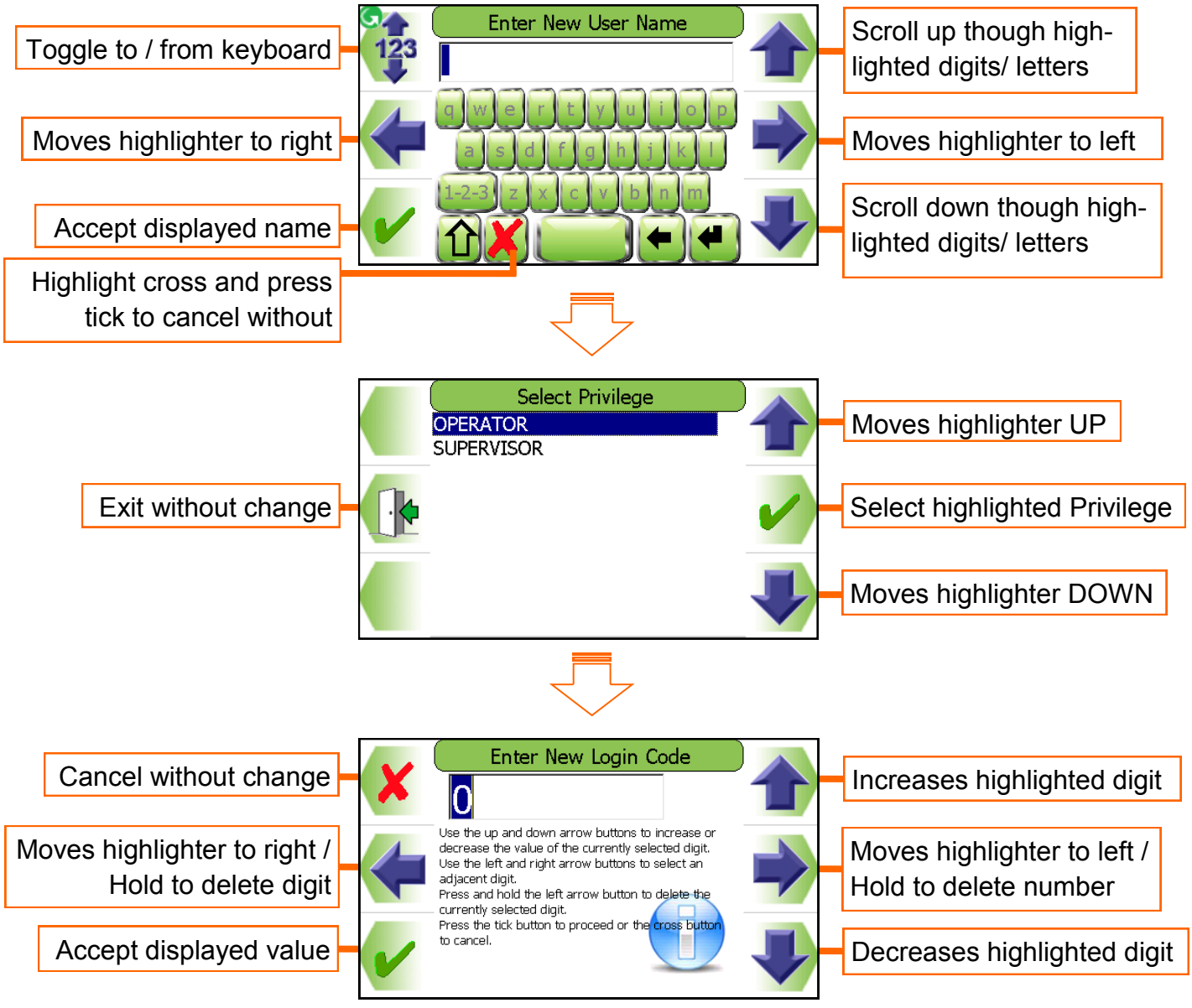
14.1 User Login Setup

Requires supervisor access rights.



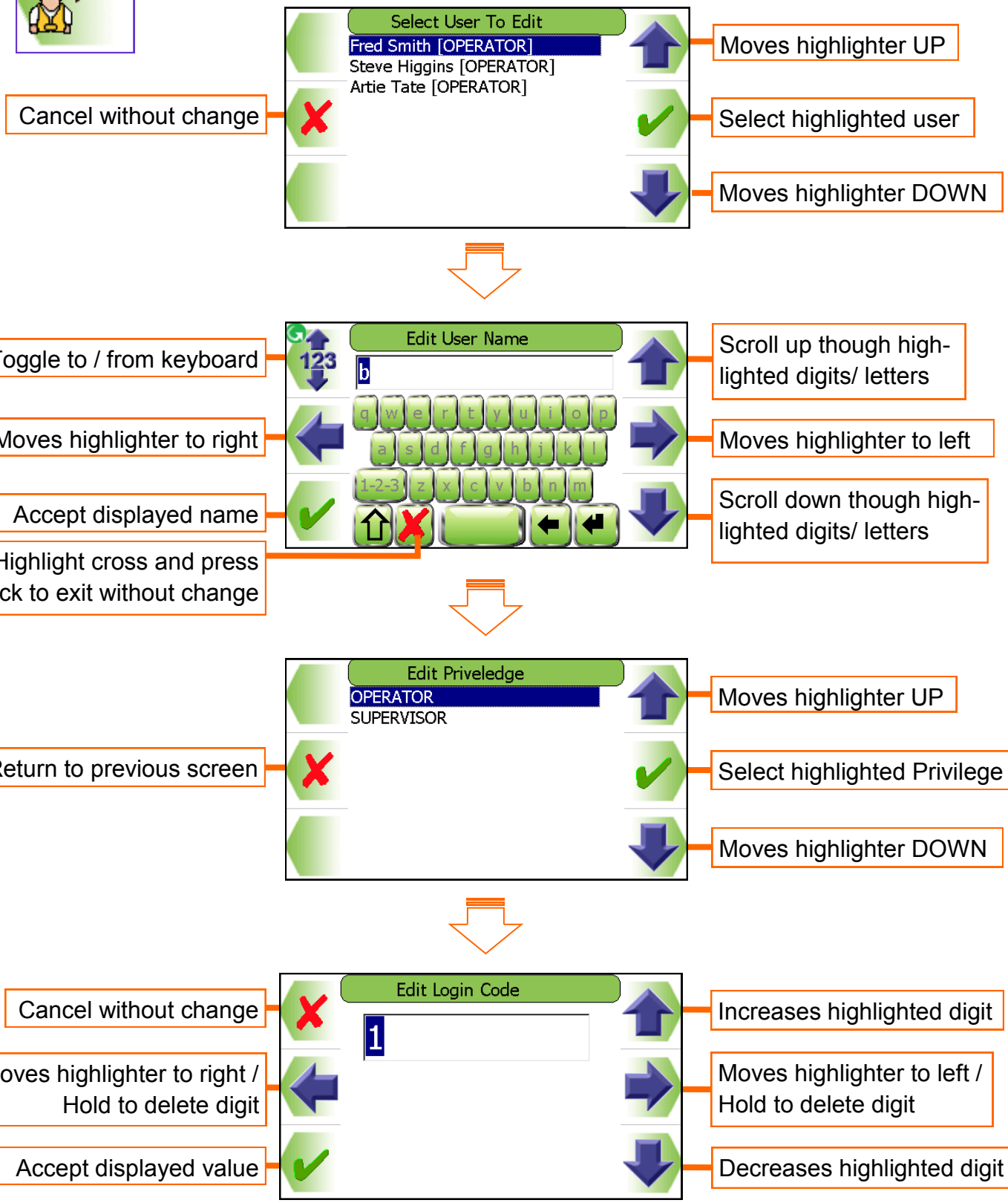
14.2 Add New User to Login

Requires supervisor access code


Toggle to / from keyboard
Moves highlighter to right
Accept displayed name
Highlight cross and press tick to cancel without
Enter New User Name
123
Scroll up though high-lighted digits/ letters
Moves highlighter to left
Scroll down though high-lighted digits/ letters
Select Privilege
OPERATOR
SUPERVISOR
Exit without change
Moves highlighter UP
Select highlighted Privilege
Moves highlighter DOWN
Cancel without change
Moves highlighter to right / Hold to delete digit
Accept displayed value
Enter New Login Code
0
Use the up and down arrow buttons to increase or decrease the value of the currently selected digit.
Use the left and right arrow buttons to select an adjacent digit.
Press and hold the left arrow button to delete the currently selected digit.
Press the tick button to proceed or the cross button to cancel.
Increases highlighted digit
Moves highlighter to left / Hold to delete number
Decreases highlighted digit

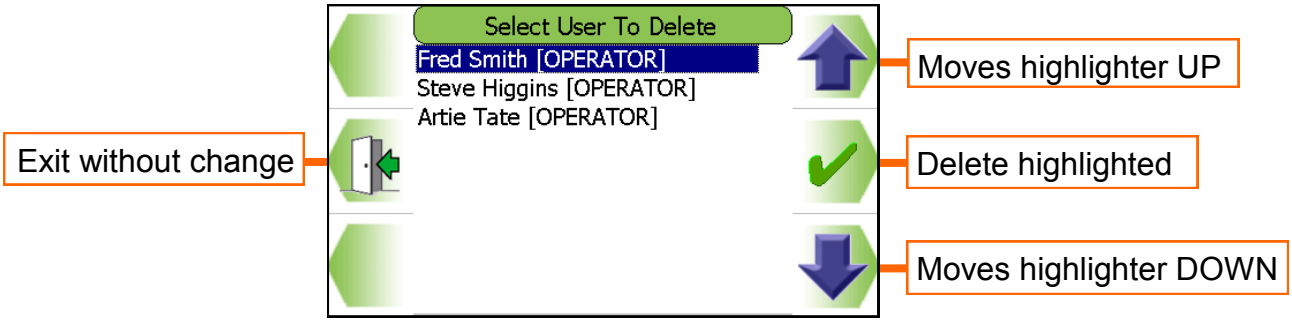
14.3 Edit User Details

Requires supervisor access rights.



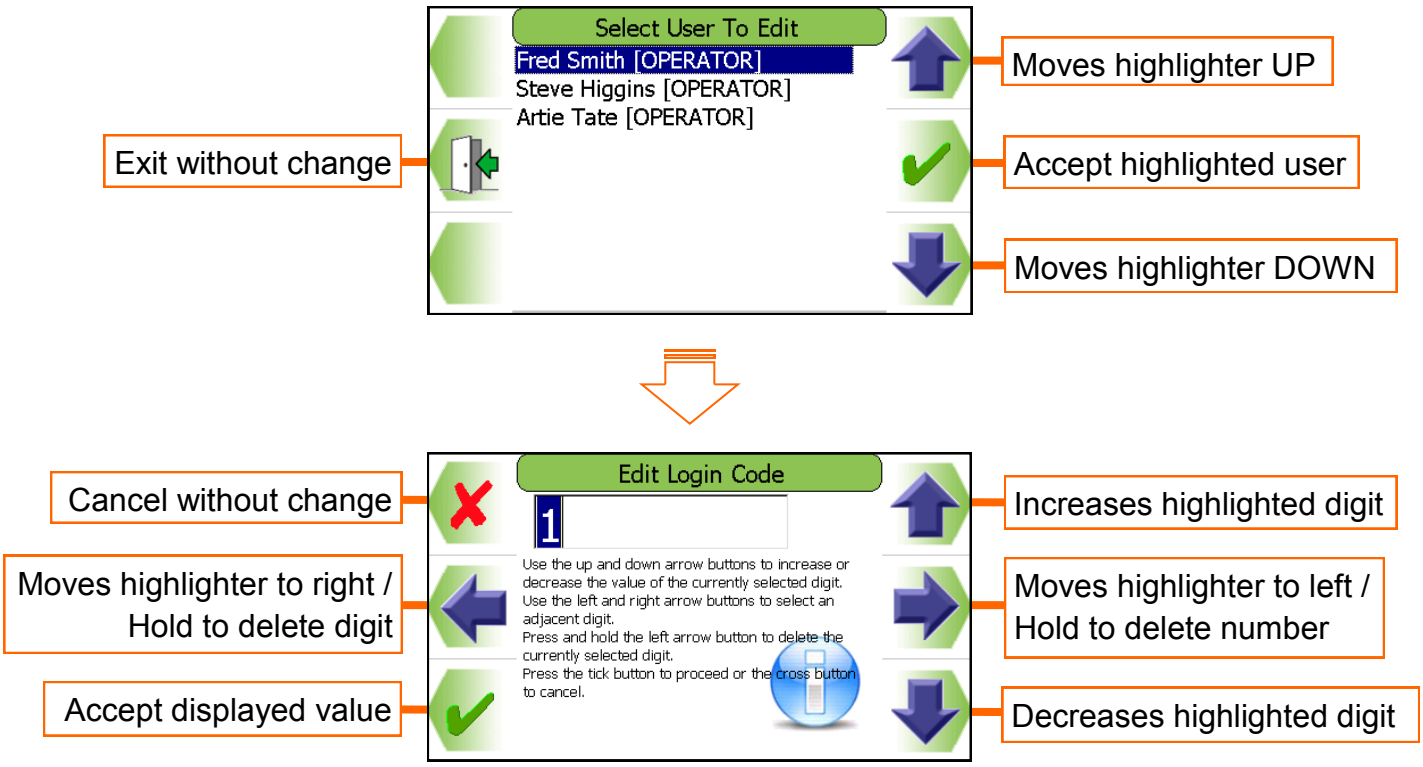
14.4 Select User to Delete

Requires supervisor access rights.



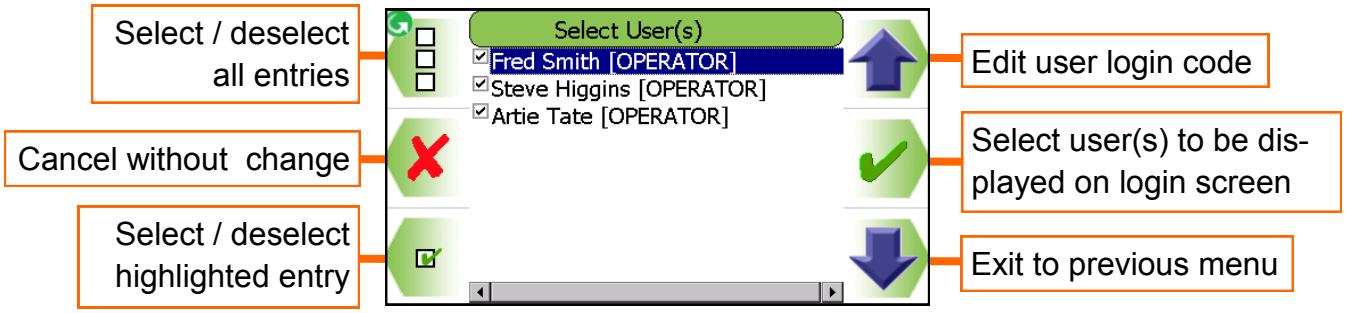
16.5 Edit User Access Code

Requires supervisor access rights.

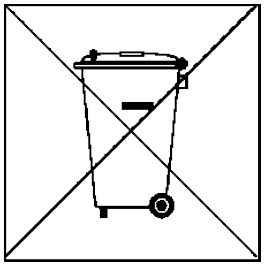

Select User To Edit
Fred Smith [OPERATOR]
Steve Higgins [OPERATOR]
Artie Tate [OPERATOR]
Exit without change
Moves highlighter UP
Accept highlighted user
Moves highlighter DOWN
Edit Login Code
1
Use the up and down arrow buttons to increase or decrease the value of the currently selected digit.
Use the left and right arrow buttons to select an adjacent digit.
Press and hold the left arrow button to delete the currently selected digit.
Press the tick button to proceed or the cross button to cancel.
Cancel without change
Moves highlighter to right / Hold to delete digit
Accept displayed value
Increases highlighted digit
Moves highlighter to left / Hold to delete number
Decreases highlighted digit

14.6 Enable / Disable Users

Requires supervisor access rights


Select / deselect all entries
Cancel without change
Select / deselect highlighted entry
Select User(s)
Fred Smith [OPERATOR]
Steve Higgins [OPERATOR]
Artie Tate [OPERATOR]
Edit user login code
Select user(s) to be displayed on login screen
Exit to previous menu

15 Taking Product out of Operation



Prolec Limited is committed to complying with the upcoming European Directive of RoHS (Restriction of Certain Hazardous Substances) and WEEE (Waste from Electrical and Electronic Equipment). PME is subject to the WEEE directive, therefore PME or any component must be returned to Prolec Ltd for correct disposal or recycling.
The display and safety controller are fitted with internal batteries and must not be disposed of in landfill.

16 Service and Repair

PME has very few user serviceable parts. The safety controller has internal fuses that, in the event of a blown fuse, can be replaced. The service section describes daily, monthly and yearly checks that must be carried out to ensure safe operation of the system.

16.1 Maintenance Review

Due to nature of the PME system operating environment, changes in usage can occur. Prolec Ltd must be notified of any changes in the pattern of use of the system for consideration.
Any alterations or modifications to machine components which affect the system must be reported to Prolec Ltd or via the service agreement holder.
To aid in the use of PME, all appropriate technical bulletins relating to PME are to be assessed and implemented as appropriate. This information is available from Prolec Ltd.
Prolec Ltd must be informed of any Prolec system component failure. Be it directly or via the service agreement holder.
Technical consultation is available to the user, contact Prolec Ltd or the service agreement holder.

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17 Definitions / Glossary

Definitions of words used to ensure understanding

P/N	Part Number
Boom	First articulation connected to turret
Dipper	Second articulation - third articulation when attached to a hydraulically adjustable boom (Arm)
Artic	Second articulation of a hydraulically adjustable boom (luffing boom, knuckle boom, two piece boom)
Turret	Section of machine above the undercarriage
Undercarriage	Section which the tracks/wheels attach too
Track	continuous band of treads, metal or rubber covered
Wheeled excavator	An excavator fitted with wheels
Tracked excavator	An excavator fitted with tracks, also known as
Bucket	Digging attachment
Attachment	Tool fixed to the dipper other than a bucket
SC	Safety Controller
MMI	Man Machine Interface (i.e. Display)
CAN cable	Cable connecting system components
Angle sensor	Sensor detecting current equipment angle
Pitch	Longitudinal base machine angle (fore / aft or gradient)
Roll	Lateral base machine angle (side to side or cant)
Motion Cut	Direct control of component hydraulic service
Power Supply	DC supply voltage
Ram	Hydraulic Cylinder
Blade	heavy metal plate on the front of the machine, used for stability and moving material
Stabiliser	Hydraulically powered arms that can be lowered and raised to increase the Stability of the machine
Counterweight	Weight attached to the rear of an excavator to increase digging force and lifting capacity
Pivot pin	Point at which the articulations rotate about
Motion Cut	Restriction to a hydraulic or electronic circuit in
Slew restriction	Angular slew, virtual wall, multipoint wall
Slew limit	A settable angle or virtual wall

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